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PERISTALYSIS OF THE GENITAL TRACT, AND A NEW THEORY TO EXPLAIN RELAXA- TION OF THE VAGINAL OUTLET DURING LABOR.

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ABOUT two years ago, being summoned to attend a young primipara already in labor, I was impressed with the rigidity of the perineum and the small caliber and unyielding character of the whole vaginal tract. I was fully convinced that delivery could not be effected without serious rupture of the vagina and perineum. Finding that she was in the first stage of labor, with but slight dilatation of the external os under the operation of moderate uterine pains, I left her for two hours and returned, oppressed with concern about the issue of the labor. To my surprise and delight I found the vaginal entrance gaping and the whole tract capacious; the perineum and walls of the vagina were in a state of utmost relaxation. I hastily inferred that the head of the child must have escaped from the neck of the womb and been forced into the vagina and down upon the perineum, so as to have produced the marked change which I noted. This proved not to be the case; the external os was fully dilated, but had not retracted over the head, which was firmly lodged at the entrance to the pelvis. Clearly the relaxation of the vagina and perineum were not attributable to mechanical dilatation. Of course, I was able to recall many instances of this relaxation in the last stage of labor, yet my attention had never been riveted by its contrast with the other extreme of rigidity and narrowness by two accurate observa-

tions on the same patient. Delivery was completed without rupture, and the notable phenomena were soon after relegated to the limbo of half-forgotten observations, until they were brought afresh into prominence by another case of different nature.

Six months later I was called to a woman of whom the best and the worst that can be said is that, in the words of Bret Harte, "her improprieties were purely professional." She had been flowing for several weeks, owing to the presence of a fibroid tumor as large as a peach in the fundus of the womb. I prescribed thirty drops of the fluid extract of ergot three times a day. A month later she reported no arrest, or even diminution, of the flow, and complained of the constant recurrence of bearing-down pains—i. e., of violent uterine contractions. That this last interpretation of the painful sensations which she had experienced was correct may be adduced the fact that the tumor was later spontaneously forced down to the external os and removed with the scissors after dilatation of the cervix. The immediate results of my prescription were, of course, in the highest degree unsatisfactory; but the chief complaint of the patient was that my medicine had caused great relaxation of the vaginal entrance. I was able fully to corroborate her assertions, for, instead of a closure of the canal so unyielding as greatly to impede the examination at my first visit, and to excite my surprise because of her mode of life, I found the parts so extremely patulous as to admit two fingers with the greatest ease. On substituting for the ergot a mineral acid to check the flow, the uterine contractions immediately ceased for the time and the vaginal entrance returned to its former tightly constricted state.

This observation at once allied itself in my mind with that made upon the woman who was in labor, but led me, of course, to revise my previous hasty assumption that the atonic condition of the vagina was one of the many provisions of nature, with special reference to pregnancy and its termination by delivery of the child. Here was precisely the

same result in a totally different sort of case. Yet there was clearly a parallel in the object to be attained in both—the expulsion of a body from the genital tract, and, what was most to the point, the initial stage of the process of expulsion was effected by the same mechanism, active contractions of the womb. Herein was evidently the clew to the condition of the vagina.

The question at once presented itself, Why should contractions of the womb lead to relaxation of the vagina? The problem was one of physiology and not of physics, for in neither instance was there any mechanical distention of the canal. An elucidation of this law may, I believe, be obtained by analogy with other organs having a similar structure and similar functions.

To trace this I must recall to the minds of those present a study that I made several years ago of "The Functions of the Anal Sphincters, so called, and the Act of Defecation."¹ In this contribution I quoted from Gowers² the following description of the peristaltic action of the intestines:

"The effect, therefore, of the presence in the intestine of a mass of feces, or other contents, would be to cause, first, in the moderately contracted intestinal wall in front of it, an increased contraction, the effect of which would be to prevent the diffusion of the contents along the intestine (which would materially interfere with their movement); secondly, complete relaxation of the next portion of the intestinal wall into which the contents of the intestine could pass; and, thirdly, a strong contraction behind, sustained and moving as the stimulating body, as the initial contraction gave place to relaxation."

My point, then, was to prove that this physiological act applied equally well to the so-called third sphincter and the internal sphincter, both of which I showed to be in structure but parts of the circular muscular layer of the intestine, and to operate by expanding in front of the fecal mass and con-

¹ *Trans. Am. Gynec. Soc.*, vol. ii, pp. 43-56, 1877.

² *Proc. Royal Society*, No. 179, 1877. Reprint, p. 7.

tracting behind it, acting not as sphincters but as *detrusores facium*. This view has met general acceptance.

In the *bladder* the circular fibers of the middle coat become more pronounced near the orifice of the urethra, and the "layer they there form has commonly but erroneously been regarded as the true sphincter vesicæ. The fibers just described may be collectively termed the *detrusor urinæ*, and their contraction effects the expulsion of the urine from the bladder."¹

I have observed in cases of irritable neck of the bladder that pressure upon and irritation of the full bladder through the abdominal wall has in certain cases failed to cause evacuation of urine until peristaltic action has been set up in the walls of the bladder, as was manifest to the touch through the abdominal walls. This contraction gives rise to inhibition of the unstriped muscles encircling the neck (sphincter vesicæ), which counteract the reflex contractions excited by contact of the urine with the abnormally sensitive mucous membrane covering these muscular fibers, and allows the urine to flow through in turn. Peristalsis in these two organs does not take place in identically the same manner, but differs to meet the special requirements. In the intestine there seems to be a contraction of the muscles throughout the entire circumference of one segment of the tube during a brief period of time; the inhibition of the next lower segment partakes of the same periodicity. In the bladder there is not normally a contraction of the muscular fibers of the entire circumference at the same time, but the successive contraction of limited areas; this modification may be assumed to have been designed to maintain continuously for a longer time the inhibition of the fibers encircling and closing the neck of the bladder. Each form of peristalsis is specially adapted to the different character of the contents of each viscous.

Let us now consider what grounds there are for attributing an analogous function to the genital tract. The Fallo-

¹ "Physiology of Micturition and Retention of Urine," by Henry Power, M. B. *Practitioner*, January, 1875, p. 39.

pian tubes, uterus, and vagina must be regarded as one tube, being differentiated embryonically from the two ducts of Müller. The walls of all these consist mainly of two layers, the fibers of the external being arranged longitudinally and those of the internal transversely, the disposition being the same as in the intestines and bladder. The muscles are made up entirely of unstriped fibers, as in the other organs. Like the bladder and intestines, the contractions of the tubes and uterus are under the influence of the spinal and ganglionic systems of nerves, and occur rhythmically; those of the vagina in women have not been hitherto observed or recorded, but may, from analogy, be supposed to follow the same law.

In considering peristaltic action of the womb by virtue of which it expels its contents—whether that be an ovum, a ripe fetus, a tumor, or a foreign body, such as a sponge-tent—we can not fail to recognize a mode of action similar to that of the other excretory organs. As the vagina is formed from the same embryonic organs as the uterus, is seen to have its muscular walls made up of the same unstriped fibers, arranged in the same two layers of circular and longitudinal fibers, and is under the control of the same system of nerves, it is reasonable to infer that it possesses similar modes of action, though these be modified to meet the special purpose for which it is designed. It would seem from my observations that the vagina in woman is not subject to periods of inhibition and contraction corresponding to the contractions and relaxation of the uterine walls, but that the inhibition does not take place until the tract of the canal connecting with the uterine body—namely, the cervix—is fully dilated, and that the inhibitory relaxation thus established persists until the contained body is expelled and the uterine contractions cease. It would seem, furthermore, that the neck of the womb is not amenable to the same inhibitory influence as the rest of the genital tract, but requires to be dilated by mechanical pressure. This point I am not prepared to discuss now.

The above pages were written two years ago, when I was unaware—so brief have been the allusions in the text-books on obstetrics—that the expulsive powers of the uterus and vagina had been described as a form of peristalsis. Investigation, however, shows that the theory has been to a certain extent recognized, but, as it seems to me, its importance inadequately appreciated. For instance, Leishman devotes less than a page to the subject, referring only to the uterus, and Lusk barely alludes to it. The fact that the vagina may be likewise the seat of peristalsis is ignored in the general treatises, and perhaps properly so, as far as the human species is concerned, for expulsive action on the part of the vagina is probably very slight, because it is not needed, owing to the comparatively great length of the human product in proportion to the length of that organ. In many animals, however, this disproportion in length does not exist, and propulsive power will probably be shown to take place quite generally when the mechanism of labor in them has been more thoroughly studied. It has been demonstrated to be a potent factor in the expulsion of the fetus in rabbits by Kehrer,¹ and quite recently by Jastreboff.²

Kehrer divides the contractions of the uterus into three varieties—the *progressive*, the *localized* (striicture), and the *universal* (tetanus). In his experiments with rabbits, the mere exposure to air would often give rise to a contraction which advanced through the whole genital canal, while by chemical, mechanical, electric, and thermal irritation, contractions could be started at almost any point, and were transmitted in one or the other direction. “Most frequently the contractions proceed from the abdominal opening of the tube to the mouth of the womb—peristalsis; less frequently in the opposite direction—antiperistalsis. Moreover, some of the progressive contractions do not originate at any mouth of the canal, but at some intermediate point.”³

¹ “Ueber die Zusammenziehungen des weiblichen Genitalcanals.” *Inaug. Diss.*, Giessen, 1863.

² “Ueber die Contraction der Vagina bei Kaninchen.” *Archiv für Physiologie*, Jahrgang 1884, Leipzig. ³ Kehrer, *loc. cit.*, p. 13, *et seq.*

"The contractions of the uterus during delivery—the true labor-pains—are composed of three separate motions, which are completely blended together: of an antiperistaltic transverse, a longitudinal, and a peristaltic transverse contraction."

"The contraction of the vagina in a non-pregnant animal is similar to the above; it either follows immediately upon the peristaltic contraction of the uterus, or begins in the vagina itself. Its course is predominantly peristaltic, but anti-peristaltic movements may be aroused by irritating the upper end of the vagina or the vestibule."

Kehrer sums up the results of his experiments in the following statements:

1. The solid or fluid contents are driven, either wholly or in part, out of the contracted segment of the genital tract.
2. When relaxation supervenes, the contents, wholly or in part, retreat into the segment, which has been contracted.

The same author illustrates many other phases of the theme which have less bearing upon my topic, but records one observation confirmatory of my theory as follows: "After a series of vaginal contractions had been observed, I replaced the genitals in the abdominal cavity and closed the abdominal walls over them. The vulva was small before the observation and its mucous membrane was of the usual red color. *It was now seen to be enlarged in all dimensions, its contour was more rounded, its mucous membrane was swollen and of a bluish-red color.*" (The italics are mine.)

The above experiments were made several years before the inhibitory phenomena were recognized as an essential part of peristalsis, so that it is no wonder that Kehrer should not have explained this relaxation of the vaginal outlet as I am seeking to do.

It is a source of regret to me that I must present this subject with evidence inadequate to compel assent to the theory advanced to explain vaginal relaxation, yet I trust that I have established a presumption in its favor which will stimulate others to make and record observations in this field.

I would also insist upon the established fact that peristalsis is the normal mode of action of each and every division of the genital tract, Fallopian tube, uterus, and vagina, and that many anomalous phenomena and many symptoms can only be correctly interpreted by reference to this mode of motion. Uterine colic is a familiar illustration; vaginal colic must be rare, yet its assumption would alone explain the peculiar symptoms in two or three cases that I can recall. Tubal colic, in various degrees, I believe to be of very common occurrence, but not easily demonstrable. I believe it to be the true morbid phenomenon that gives rise to most of the lancinating pains that are usually denominated as ovarian neuralgia—a belief which receives much support from Lawson Tait's insistence upon the removal of the tubes as well as the ovaries in most oöphorectomies. In fact, the evidence is so strong as to raise the question whether removal of the ovaries is not superfluous in most of these operations.

The immediate expulsion from the vagina of the seminal fluid *post coitum*, and the consequent sterility, may be regarded as an illustration of exaggerated peristaltic action of the vagina, as may also, in a most marked degree, the disease known as *vaginismus*.

The long discussion as to whether the uterus could be regarded as an erectile body, which has finally been established in the negative by the demonstration that it lacks an investing fibrous sheath essential to secure rigidity, would have been speedily silenced had it been appreciated that all the phenomena adduced in proof of its erectile power could have been equally well explained by the theory of peristaltic contraction in the body of the uterus with or without its propagation to the vagina. Such are a few of the practical lessons to be learned from keeping in mind this important function of the whole genital tract.

